

REMARKS

The Office Action mailed on May 14, 2001, has been received and reviewed. Claims 1-20 and 32-71 are currently pending in the application. Claims 1-20 and 32-71 stand rejected. Reconsideration of the application is respectfully requested.

Rejections Under 35 U.S.C. § 112, First Paragraph

Claims 1-11, 32-38, and 68-71 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention.

The originally filed specification, at page 7, lines 23-25, describes that a *dielectric* element 19 (FIGs. 2 and 3) surrounds the lateral peripheral portions of a phase change component 13. In describing element 19 as being formed from a dielectric material, the originally filed specification provides support for the recitation of an oxide-containing protective layer, as recited in independent claims 1, 32, and 68. Moreover, the originally filed specification incorporates by reference all of the teachings of U.S. Patents 5,789,758 (hereinafter "Reinberg") and 5,789,277 (hereinafter "Zahorik"). Reinberg, at col. 5, lines 60-63, describes such a dielectric element 19 (elements 35 and 95 of Reinberg) as comprising oxide layers. Zahorik, at, for example, col. 10, lines 26-29, similarly describes such as dielectric element 19 (element 210 of Zahorik) as being formed from, among other materials, TEOS oxide and PECVD oxide.

For these reasons, it is respectfully requested that the Office withdraw the rejections of claims 1-11, 32-38, and 68-71 under 35 U.S.C. § 112, first paragraph.

Rejections Under 35 U.S.C. § 102(e) or 35 U.S.C. § 103(a)

Brown

Claims 1-6, 8-10, 32-38, 68 and 70 stand rejected under 35 U.S.C. § 102(e) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent 5,792,594 to Brown et al. (hereinafter "Brown").

With respect to rejections under 35 U.S.C. § 102, a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Brown discloses a method for repatterning semiconductor dice for use in flip-chip applications, as well as various products of the method. The method disclosed in Brown includes forming a first dielectric polymer layer on an active surface of a semiconductor die, exposing bond pads of the semiconductor die through the first dielectric polymer layer, forming a second dielectric polymer layer over the first dielectric polymer layer, and exposing the bond pad and areas of the first dielectric polymer layer upon which circuit traces are to be carried through the second dielectric polymer layer. The first dielectric polymer layer includes a catalyst. A catalytic metal is also deposited onto the exposed bond pad. The catalyst of the first dielectric polymer layer and the catalytic metal of the exposed bond pad facilitate copper plating of the first dielectric

polymer layer and of the bond pad. The exposed portion of each bond pad and the exposed portions of the first dielectric polymer layer are then plated with a metal, such as copper, that has better conductivity properties and is less corrosive than aluminum. Upon patterning the metal plating, conductive lines and contact pads are formed.

In one described example of the resulting semiconductor die, the new contact pad is formed directly above the corresponding bond pad and is separated from the active surface of the semiconductor die by the two dielectric polymer layers. Brown does not disclose that the formed structure is useful for anything other than to produce a precision interconnecting pattern and terminal bump pattern from metals other than aluminum so as to enhance the performance of a semiconductor die. Col. 2, lines 46-49 and 55-57.

Claim 1 recites a contact that includes an intermediate conductive layer, an insulator component positioned “so as to at least thermally insulate [a] structure” of the semiconductor device, and an electrically conductive contact layer. The intermediate conductive layer of claim 1 is positioned *adjacent to* and in electrical communication with *the structure, which is located beneath a bond pad-bearing surface* of a silicon oxide protective layer of the semiconductor device.

In Brown, the contact is positioned adjacent to a bond pad, which itself is located over a bond pad bearing surface of the semiconductor device. Thus, Brown does not disclose, teach, or suggest a contact that includes “an intermediate conductive layer positioned *adjacent to* and in electrical communication with *a structure located beneath a bond pad-bearing surface* of a silicon oxide-containing protective layer” (emphasis supplied) of a semiconductor device, as is recited in independent claim 1.

Moreover, Brown lacks any express or inherent description, teaching, or suggestion that the insulator component of the contact thereof may be positioned so as to thermally insulate an underlying structure of the semiconductor device.

Therefore, Brown does not expressly or inherently describe, teach, or suggest each and every element of claim 1. Accordingly, it is respectfully submitted that claim 1 is neither anticipated nor rendered obvious by Brown.

Claims 2-6, 8-10, and 68 are each allowable, among other reasons, as depending from claim 1, which is allowable.

In addition, claim 10 is allowable since Brown lacks any express or inherent description, teaching, or suggestion that the contact thereof may include a contact layer comprising "a material having a melting temperature that is greater than a temperature required to switch a phase change component in electrical communication with the contact between a plurality of states." In fact, Brown lacks any suggestion that the contact disclosed therein may be positioned adjacent to a structure that includes a phase change component or that the semiconductor device disclosed therein could even include a phase change component.

Claim 68 is additionally allowable since Brown does not expressly or inherently describe, teach, or suggest that an intermediate conductive layer or an electrically conductive contact layer of the contact described therein may abut a silicon oxide-containing structure. Rather, the Brown discloses that the copper contacts thereof are in contact with a photodefinable resin layer.

Further, it is respectfully submitted that one of ordinary skill in the art would not have been motivated by either Brown or the knowledge that was generally available in the art before the filing date of the above-referenced application to modify the teachings of Brown in the manner that has been asserted to render unpatentable the subject matter recited in claim 68. Specifically, the copper conductive portions of the contact of Brown could not contact a silicon oxide-containing structure, as recited in claim 68, since, as is well known to those of skill in the art, copper reacts with silicon-containing materials in a manner that causes the copper to blister or delaminate from adjacent silicon-containing structures, such as structure formed from a silicon oxide or a glass.

For the same reason, it is respectfully submitted that there would have been no reason for one of ordinary skill in the art to expect that modifying the teachings of Brown in the asserted

manner would have been successful. A copper contact cannot abut a silicon oxide-containing protective layer without resulting in blistering or delamination of the copper contact from the protective layer.

It, therefore, appears that modification of the teachings of Brown in the asserted manner could only have been based upon the benefit of hindsight provided by the subject matter disclosed and recited in the claims of the above-referenced patent application.

With respect to independent claim 32, it is understood that, as a product-by-process claim, the only limitations considered by the Office in determining patentability thereof are the product limitations.

Independent claim 32 recites, among other things, a contact that includes "a contact layer and an intermediate conductive layer which partially contact one another and substantially envelop an insulator component . . ." *The contact is "positioned adjacent to a structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of the semiconductor device so as to at least thermally insulate underlying structure."*

It is respectfully submitted that Brown does not expressly or inherently describe, teach, or suggest a contact that is positioned adjacent to a structure located beneath a bond pad-bearing surface of a silicon oxide-containing protective layer of a semiconductor device. Rather, the description of Brown is limited to positioning the contact thereof adjacent to a bond pad or laterally offset from other structures of the semiconductor device.

Further, Brown fails to expressly or inherently describe, teach, or suggest that the contact thereof may be positioned so as to at least thermally insulate the adjacent structure.

Therefore, Brown does not expressly or inherently describe each and every element of claim 32 or teach or suggest each and every limitation of claim 32.

Each of claims 33-38 and 70 is allowable, among other reasons, as depending from claim 32, which is allowable.

Claim 70 is additionally allowable since Brown does not expressly or inherently describe, teach, or suggest that an intermediate conductive layer or an electrically conductive contact layer of the contact described therein may abut a silicon oxide-containing structure. Rather, the Brown discloses that the copper contacts thereof are in contact with a photodefinable resin layer.

Further, it is respectfully submitted that one of ordinary skill in the art would not have been motivated by either Brown or the knowledge that was generally available in the art before the filing date of the above-referenced application to modify the teachings of Brown in the manner that has been asserted to render unpatentable the subject matter recited in claim 70. Specifically, the copper conductive portions of the contact of Brown could not contact a silicon oxide-containing structure, as recited in claim 70, since, as is well known to those of skill in the art, copper reacts with silicon-containing materials in a manner that causes the copper to blister or delaminate from adjacent silicon-containing structures, such as structure formed from a silicon oxide or a glass.

For the same reason, it is respectfully submitted that there would have been no reason for one of ordinary skill in the art to expect that modifying the teachings of Brown in the asserted manner would have been successful. A copper contact cannot abut a silicon oxide-containing protective layer without resulting in blistering or delamination of the copper contact from the protective layer.

It, therefore, appears that modification of the teachings of Brown in the asserted manner could only have been based upon the benefit of hindsight provided by the subject matter disclosed and recited in the claims of the above-referenced patent application.

Accordingly, it is respectfully requested that the Office withdraw the rejections of claims 1-6, 8-10, 32-38, 68, and 70 under 35 U.S.C. §§ 102(e) and 103(a).

Brown in View of Whitten

Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Brown in view of U.S. Patent 5,451,811 to Whitten et al. (hereinafter "Whitten").

Claim 11 is allowable, among other reasons, as depending from claim 1, which is allowable. Further, it is respectfully submitted that the combination of Brown and Whitten does not teach or suggest each and every element of claim 11. While it is acknowledged that Whitten states, at col. 4, lines 55-57, that a variety of conductive materials may be used as the upper electrode thereof, including "aluminum, titanium-tungsten, molybdenum, or copper", it is respectfully submitted that copper could not have been used since Whitten also discloses that the dielectric layer underlying the upper electrode is formed from silicon dioxide. (Col. 4, lines 29-31) without indicating that any dielectric materials that do not include silicon atoms could be used to form the dielectric layer. Brown includes no express or inherent description, teaching, or suggestion of the use of aluminum, refractory metals, or refractory metal nitrides as the contact layer of a contact. Brown only teaches that the repatterned terminals thereof are formed from copper or other conductive materials "other than aluminum". *See, e.g.*, col. 2, lines 55-57.

Further, it is respectfully submitted that one of ordinary skill in the art would not have been motivated by Brown, Whitten, or the knowledge that was generally available in the art to combine the teachings of Brown and Whitten in the asserted manner. Specifically, Brown teaches an external contact for a semiconductor device, while the portion of Whitten that is relied upon is drawn to an embedded upper electrode of an antifuse.

For these reasons, it is respectfully requested that the 35 U.S.C. § 103(a) rejection of claim 11 be withdrawn.

Sasaki in View of Brown

Claims 7, 12-19, 39-54, 56-66, 69, and 71 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese patent application 04-045585 of Sasaki (hereinafter "Sasaki") in view of Brown.

Sasaki teaches a phase transition type memory element that includes a chalcogenide phase transition element between upper and lower electrodes. The memory element depicted in Sasaki

appears to include a bond pad positioned over the upper electrode thereof, as well as over the phase transition element.

The teachings of Brown were summarized previously herein.

Independent claim 12 recites a contact for a memory element that includes a phase change component. The contact of claim 12 includes, among other things, an insulator component, an intermediate conductive layer adjacent the insulator component and in electrical and thermal communication with the memory element, and a contact layer adjacent the insulator component and in electrical contact with the intermediate conductive layer.

While it is acknowledged that Brown teaches a contact that includes upper and lower conductive layers with a thermally insulative element therebetween and that Sasaki teaches a memory element that includes a phase change component, it is respectfully submitted that there are several reasons that the Office has not met its burden of establishing a *prima facie* case as to the obviousness of independent claim 12.

First, it is respectfully submitted that one of ordinary skill in the art would not have been motivated by Sasaki, Brown, or the knowledge that was generally available in the art prior to the filing date of the referenced application to combine the teachings Sasaki and Brown in the manner that has been asserted. Specifically, one of ordinary skill in the art would not have been motivated to substitute the contact of Brown for the bond pad of Sasaki. This is because Brown teaches forming a contact that communicates with a bond pad, not replacing the bond pad with the contact. Thus, it appears that the most that one of ordinary skill in the art would have been motivated to do would be to form the contact of Brown over the device of Sasaki such that the contact of Brown communicates with the bond pad of Sasaki.

Further, the result of combining the teachings of Sasaki and Brown would not have been the subject matter recited in independent claim 12 (*i.e.*, a contact that includes an intermediate layer positioned between a memory element including a phase change component and an insulator component of the contact, as well as a contact layer adjacent the insulator component and in electrical contact with the intermediate conductive layer), but rather a memory device that

includes a contact that communicates with a bond pad, which bond pad is positioned between the contact and an upper electrode of a memory element that includes a phase transition element. Accordingly, it is also respectfully submitted that there would have been no reasonable expectation that the combination of Sasaki and Brown would successfully result in a contact comprising the elements that are recited in independent claim 12.

Claims 13-19 are each allowable, among other reasons, as depending from claim 12, which is allowable.

Claim 16 is further allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer comprising a material that has a melting temperature that is greater than a temperature that will switch a phase change material from a first state to a second state.

Claim 17 is further allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer that may be formed from at least one of a refractory metal, a refractory metal nitride, and aluminum.

Claim 19 is additionally allowable because Sasaki and Brown, taken alone or in combination, both lack any teaching or suggestion of a contact that includes a contact layer that comprises a material that has a melting temperature that is greater than a temperature required to switch a phase change material of a phase change component from a first state to a second state.

Independent claim 39 recites an electrically erasable programmable memory device that comprises a memory element including an electrode and a memory cell, at least one of which comprises a phase change material. The device of claim 39 also comprises a contact that includes an intermediate conductive layer positioned adjacent to and in electrical and thermal communication with the memory element, an insulator component adjacent the intermediate conductive layer, and a contact layer adjacent the insulator component and in electrical communication with the intermediate conductive layer.

For the same reasons provided above with respect to independent claim 12, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine the teachings of Sasaki and Brown in the manner that has been asserted in the outstanding Office Action.

It is also respectfully submitted that, even if such a combination were made, Sasaki and Brown could not be successfully combined in a manner that would result in the electrically erasable programmable memory device recited in independent claim 39. Specifically, such a device would include at least a bond pad between the phase change portion of the memory element and the intermediate conductive layer of the contact. Thus, the intermediate conductive layer could not be located adjacent to the memory element.

Thus, it is respectfully submitted that a *prima facie* case as to the obviousness of independent claim 39 has not been established.

Each of claims 40-44 is allowable, among other reasons, as depending from claim 39, which is allowable.

Independent claim 45 recites a semiconductor device that includes at least one contact. The at least one contact of claim 45 includes, among other things, an intermediate conductive layer that is positioned adjacent to and in electrical and thermal communication with a structure of the semiconductor device that comprises a phase change component. The contact also includes an insulator component adjacent the intermediate conductive layer and a contact layer adjacent the insulator component and in electrical communication with the intermediate conductive layer.

It is respectfully submitted that, for the same reasons presented herein with respect to independent claim 12, one of ordinary skill in the art would not have been motivated by Sasaki, Brown, or the knowledge that was generally available in the art to combine the teachings of Sasaki and Brown in the asserted manner.

It is further submitted that, for the same reasons provided herein with respect to independent claims 12 and 39, even had one of ordinary skill in the art been motivated to combine

the teachings of Sasaki and Brown, there would not have been a reasonable expectation that the combination could not have successfully resulted in the subject matter recited in independent claim 45.

Accordingly, it is respectfully submitted that the Office has not met its burden of setting forth a *prima facie* case as to the obviousness of independent claim 45.

Claims 46-54 are each allowable, among other reasons, as depending from claim 45, which is allowable.

In addition, claim 51 is allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer comprising a material that has a melting temperature that is greater than a temperature that will switch a phase change material from a first state to a second state.

Claim 52 is also allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer that may be formed from at least one of a refractory metal, a refractory metal nitride, and aluminum.

Claim 54 is additionally allowable because Sasaki and Brown, taken alone or in combination, both lack any teaching or suggestion of a contact that includes a contact layer that comprises a material that has a melting temperature that is greater than a temperature required to switch a phase change material of a phase change component from a first state to a second state.

Independent claim 56 recites an enhanced electrically erasable programmable element. A contact of the enhanced electrically erasable programmable element includes an intermediate conductive element that is positioned adjacent to an in electrical communication with the electrically erasable programmable element, as well as an insulator component adjacent to the intermediate conductive element and an electrically conductive contact layer adjacent to the insulator component.

Again, independent claim 56 is allowable because one of ordinary skill in the art would not have been motivated to combine the teachings of Sasaki and Brown in the asserted manner and,

further, because there would have been no reasonable expectation of success had such a combination been made. Therefore, the Office has not set forth a *prima facie* case as to the obviousness of independent claim 56.

Claims 57-66 are each allowable, among other reasons, as depending from claim 56, which is allowable.

Claim 63 is further allowable because neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer comprising a material that has a melting temperature that is greater than a temperature that will switch a phase change material of a contacted structure between a plurality of electrical conductivity states.

Claim 64 is additionally allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer that may be formed from at least one of a refractory metal, a refractory metal nitride, and aluminum.

Claim 66 is also allowable because Sasaki and Brown, taken alone or in combination, both lack any teaching or suggestion of a contact that includes a contact layer that comprises a material that has a melting temperature that is greater than a temperature required to switch a phase change material of a contacted structure between a plurality of states.

Claims 69 and 7 are allowable, among other reasons, as depending directly and indirectly, respectively, from claim 1, which is allowable.

Claim 69 is further allowable for the reasons provided herein with respect to independent claim 12: first, one of ordinary skill in the art would not have been motivated to combine the teachings of Sasaki and Brown in the asserted manner; and second, even if such a combination would have been made, there is no reason to expect that such a combination would have successfully resulted in the subject matter recited in claim 69.

Therefore, the Office has not met its burden of establishing a *prima facie* case as to the obviousness of claim 69.

In addition, claim 7 is allowable since neither Sasaki nor Brown, taken either alone or in combination, teaches or suggests a contact that includes an intermediate conductive layer comprising a material that has a melting temperature that is greater than a temperature that is required to switch a phase change component between a plurality of states.

Claim 71 is allowable as depending from allowable claim 32 and, further, for the reasons provided previously herein with respect to independent claim 12.

In view of the foregoing, it is respectfully submitted that each of claims 7, 12-19, 39-54, 56-66, 69, and 71 is allowable over the combination of Sasaki and Brown and, accordingly, requested that the Office withdraw the 35 U.S.C. § 103(a) rejections of each of these claims.

Sasaki in View of Brown and Further in View of Whitten

Claims 20, 55, and 67 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sasaki in view of Brown, as applied to claims 12, 45, and 56, and further in view of Whitten.

It is respectfully submitted that claims 20, 55, and 67 are allowable, among other reasons, based on their respective dependencies from claims 12, 45, and 56, which are each allowable.

Accordingly, it is respectfully submitted that the 35 U.S.C. § 103(a) rejections of claims 20, 55, and 67 be withdrawn.

CONCLUSION

Claims 1-20 and 32-71 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should it be determined that additional issues remain which might be resolved by way of a telephone conference, the Office is respectfully invited to contact the undersigned attorney.

Respectfully Submitted,



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